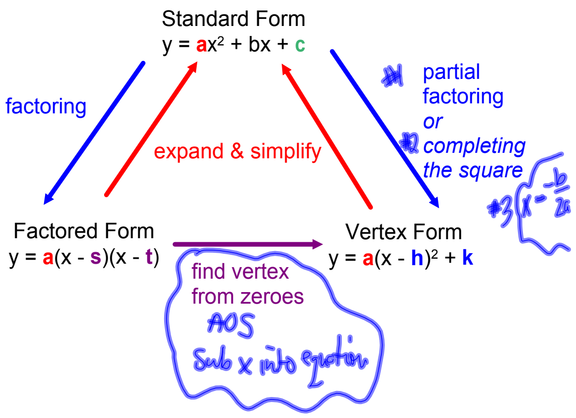
**4.5 - Relating Three Forms of a Quadratic Equation**




2x4x6

Ex.1 Expand & simplify each equation to obtain the standard form equation.

(a) $y = 2(x + 5)(x - 1)$ $\rightarrow$ $= 2(x+5)(x-1)$

$= (2x+10)(x-1)$

$= 2x^2 - 2x + 10x - 10$

$= 2x^2 + 8x - 10$

$= 2(x^2 - x + 5x - 5)$

$= 2(x^2 + 4x - 5)$

$= 2x^2 + 8x - 10$

(b) $y = -0.5(x - 4)^2 + 3$

$= -0.5(x-4)(x-4) + 3$

$= -0.5(x^2 - 4x - 4x + 16) + 3$

$= -0.5(x^2 - 8x + 16) + 3$

$= -0.5x^2 + 4x - 8 + 3$

$= -0.5x^2 + 4x - 5$

a b c

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Ex.2 Write $y = x^2 - 4x + 3$ in factored form and vertex form.

$y = x^2 - 4x + 3$

| M | A | N |
| --- | --- | --- |
| 3 | -4 | -1, -3 |

① Factor $y = (x-1)(x-3)$

② find zeros

③ AOS

④ Vertex $(2, -1)$

$x - 1 = 0$ OR $x - 3 = 0$

$\boxed{x = 1}$ $\boxed{x = 3}$

$AOS = \frac{1+3}{2}$

$x = 2$

Sub x=2 into equation

$y = (2)^2 - 4(2) + 3$

$y = 4 - 8 + 3$

$= -1$

$y = a(x-h)^2 + k$

$y = (x-2)^2 - 1$

Ex: Determine the vertex, and the vertex form, of $y = x^2 - 12x + 5$

#1 $\frac{-12}{2} = -6$

$(x-6)^2$

#2 $(-6)^2 = 36$

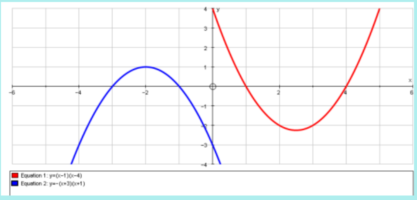
$= x^2 - 12x + 5$

$= x^2 - 12x + 36 - 36 + 5$

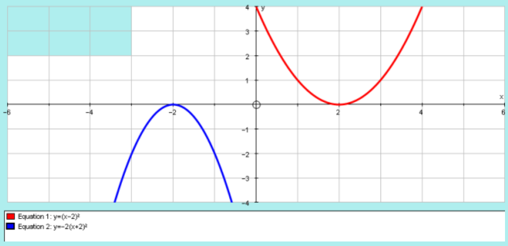
$= (x-6)^2 - 31$

If the parabola crosses the x-axis, the x-coordinates of the crossing points are called the zeroes, or roots, or x-intercepts.

A parabola may have two zeros:

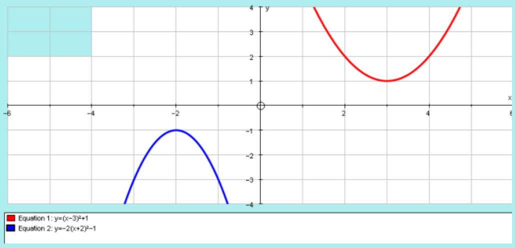



Or one zero:




$y=(x\pm\#)^2$

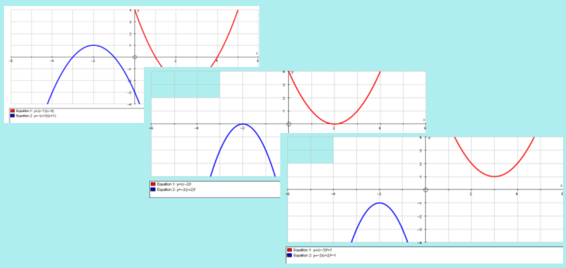
Or no zeroes:




Recall:

(1) Factored form indicates the zeroes of the quadratic relation.

(2) A quadratic relation can have 2, 1, or no zeroes.



Not all quadratics have zeroes, which means they cannot be factored. Instead, use symmetry to perform a partial factoring.

1) Determine two points that have the same y-value.
   - start with a point that is given and then find the matching point with the same y-value
   - the y-intercept is usually a good choice

2) Find the x-value of the vertex (h) using symmetry

3) Find the y-value of the vertex (k) by subbing h into the original equation.

Ex.3 Determine the vertex, and the vertex form, of
$y = x^2 - 12x + 5$

y-intercept (0,5)

by symmetry, there is another point where y=5, sub y=5, solve x

$y = x^2 - 12x + 5$

$5 = x^2 - 12x + 5$

$5 - 5 = x^2 - 12x$

$0 = x^2 - 12x$

$0 = x(x - 12)$ GCF

$x = 0$ or $x - 12 = 0$

$x = 12$

AOS: $\frac{0+12}{2}$

$x = 6$

Sub x=6 into equation

$= x^2 - 12x + 5$

$= (6)^2 - 12(6) + 5$

$= 36 - 72 + 5$

$= -31$

$\boxed{y = (x-6)^2 - 31}$

Ex. 4 Determine the vertex, and the vertex form, of
$y = -3x^2 + 15x + 2$

(0,2) y-intercept

$2 = -3x^2 + 15x + 2$

$2 - 2 = -3x^2 + 15x$

$0 = -3x^2 + 15x$ GCF

$0 = -3x(x - 5)$

$-3x = 0$ OR $x - 5 = 0$

$x = 0$, $x = 5$

AOS $= \frac{0+5}{2}$

$x = 2.5$

Sub x=2.5 into equation

$y = -3(2.5)^2 + 15(2.5) + 2$

$= 20.75$

$\boxed{y = -3(x - 2.5)^2 + 20.75}$

Assigned Work:

p.293 # 4c, 5a, 6a, 9ac, 10c
p.301 # 4c, 5ae, 7c